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SOFTWARE DEVELOPMENT: A PRODUCT LIFE-CYCLE PERSPECTIVE

Lt James W. McCord
Avionics Logistics Branch
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May 1990

Summary Report for Period of August 1989 - February 1990

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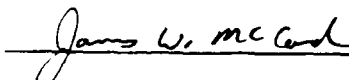
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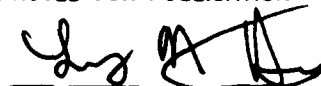
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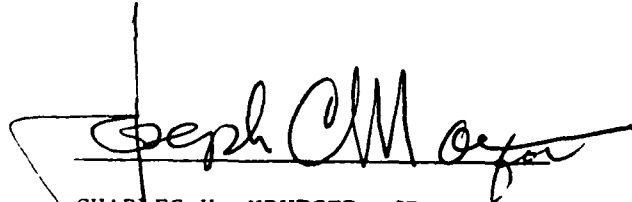
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SECURITY CLASSIFICATION OF THIS PAGE

REPORT DOCUMENTATION PAGE				Form Approved OMB No. 0704-0188	
1a. REPORT SECURITY CLASSIFICATION UNCLASSIFIED			1b. RESTRICTIVE MARKINGS		
2a. SECURITY CLASSIFICATION AUTHORITY			3. DISTRIBUTION/AVAILABILITY OF REPORT Approved for public release; Distribution unlimited		
2b. DECLASSIFICATION/DOWNGRADING SCHEDULE					
4. PERFORMING ORGANIZATION REPORT NUMBER(S) WRDC/TR-90/1063			5. MONITORING ORGANIZATION REPORT NUMBER(S)		
6a. NAME OF PERFORMING ORGANIZATION Wright Research Dev. Center		6b. OFFICE SYMBOL (If applicable) AAAF-2	7a. NAME OF MONITORING ORGANIZATION WRDC/AAAF-2		
6c. ADDRESS (City, State, and ZIP Code) Wright-Patterson AFB, OH 45433-6543			7b. ADDRESS (City, State, and ZIP Code) Wright-Patterson AFB, OH 45433-6543		
8a. NAME OF FUNDING/SPONSORING ORGANIZATION Avionics Lab WRDC/ASD(AFSC)		8b. OFFICE SYMBOL (If applicable)	9. PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER In-House		
8c. ADDRESS (City, State, and ZIP Code) Wright Patterson AFB, OH 45433-6543			10. SOURCE OF FUNDING NUMBERS		
			PROGRAM ELEMENT NO. 62204F	PROJECT NO. 2003	TASK NO. 02
11. TITLE (Include Security Classification) Software Development: A Product Life-Cycle Perspective					
12. PERSONAL AUTHOR(S) McCord, James W., 1Lt, USAF					
13a. TYPE OF REPORT Summary		13b. TIME COVERED FROM Aug 89 TO Feb 90		14. DATE OF REPORT (Year, Month, Day) 90 May	
15. PAGE COUNT 57					
16. SUPPLEMENTARY NOTATION					
17. COSATI CODES			18. SUBJECT TERMS (Continue on reverse if necessary and identify by block number) Software Development Project Management		
FIELD	GROUP	SUB-GROUP			
12	05				
12	08				
19. ABSTRACT (Continue on reverse if necessary and identify by block number) This report describes the process of software development in a commercial setting from a product life-cycle perspective. The intent of this report is to expose engineers and project managers to non-DOD software development methodologies. By being exposed to alternative software development methodologies, engineers and project managers are better able to objectively evaluate the current process of software development under DOD-STD-2167A. Through objective evaluation of this standard, DOD-STD-2167A can be tailored to best meet the needs of the software product under development.					
20. DISTRIBUTION/AVAILABILITY OF ABSTRACT <input checked="" type="checkbox"/> UNCLASSIFIED/UNLIMITED <input type="checkbox"/> SAME AS RPT. <input type="checkbox"/> DTIC USERS			21. ABSTRACT SECURITY CLASSIFICATION UNCLASSIFIED		
22a. NAME OF RESPONSIBLE INDIVIDUAL Lt James W. McCord			22b. TELEPHONE (Include Area Code) 513-255-2446		22c. OFFICE SYMBOL WRDC/AAAF-2

DD Form 1473, JUN 86

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PREFACE

As a computer research scientist for the United States Air Force, I manage the development and acquisition of computer software. The management of this software development process involves several steps which include the development of organizational goals and missions, idea generation, idea screening, development, and testing. This process, although quite lengthy and complex, does not involve the depth or breadth of the equivalent commercial software development process. As an engineer/manager in a non-commercial environment, I find the complexity and the challenges in the commercial software industry to be of special interest. Since the project management cycle in a non-commercial environment is a subset of the commercial new product management cycle, I feel that project managers should have an understanding of the development of a software product in the computer software industry.

This paper describes the complete cycle of the development of a software product in the commercial software industry. This development cycle includes three major categories. These categories are pre-development, development, and post-development activities. By carefully studying the commercial development cycle, deficiencies in the way the Air Force and the DOD develop software can be identified. Although several of the ideas described in this process do not directly relate to development in a non-commercial world, most do relate in some form or fashion. Although marketing, in the true sense, is not done in a non-commercial world, it is necessary to sell, thus market, project ideas. Throughout this paper, the terms customer and market are used. For the purposes of interpreting the usefulness of this process to non-commercial development, these terms can best be thought of as the users of the software product (major commands, logistics centers, etc).

By carefully examining the current software development process as done by the DOD and the Air Force (DOD-STD-2167A), and comparing it to the equivalent commercial development process, it is possible to better understand why DOD-STD-2167A is structured at system-level development and to objectively evaluate the merits of the current development process (DOD-STD-2167A). (K'R) ←



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Chapter One

Introduction

A serious challenge that regularly faces management is the need to improve new product performance. Organizations are dependent upon the successful development and introduction of new products for profitability and growth. New products which meet new market segments, or expand the product line, must be developed. Meanwhile, existing products eventually need to be replaced with new or improved products due to changing technologies, shifts in consumer markets, changes in consumer needs, foreign competition, or increasing costs. The organization that desires to survive and grow, must be successful in the creation of new products. (Rosenfeld 1986) This is certainly true for the software industry.

During the 1960s, as computer usage expanded and organized software development became increasingly critical and profitable, managers realized that a systematic process for software product management was needed. In order to design and develop the software product, both technical and management skills were needed by the product manager. Since that time, and especially during the past decade, changes and developments in the computer industry have occurred so rapidly that neither the technical nor the management aspects of the computer software cycle have been able to mature. Common occurrences such as cost overruns, time overruns, poor quality, and unreliable, unmaintainable computer code have contributed to the failure of products in the software industry. Fathi and Armstrong (1985) identify key reasons why potentially good software products do not actually achieve success in the marketplace. They are as follows:

- 1) Poor technical and organizational structure.
- 2) Inadequate tools for management including the lack of a well defined review plan and the identification of measureable milestones.
- 3) The development of unclear and/or ambiguous specifications as well as changing requirements.
- 4) Incomplete and vague testing plans.
- 5) Lack of user involvement throughout the duration of the product development process.

This list indicates that there is a critical need for the development of a well defined process to carry out the development and management of new software products. A

systematic process for new software product management provides numerous benefits to the software industry. Wasserman (1981) indicates that these benefits include:

- 1) Improved software reliability and quality.
- 2) Improved visibility for both management and the customer by providing a well defined schedule with reviews and measurable milestones.
- 3) Increased customer satisfaction and confidence.
- 4) Reduced software development and maintenance costs through improvements in software structure and documentation.
- 5) Well-defined organizational responsibilities and better management control through the various phases of the project.
- 6) A system which is more comprehensible and easier to maintain.

As the software industry continues to grow and mature, it is imperative that software product managers develop a product management process and philosophy which incorporates a life-cycle management approach in order to remain competitive in this complex and dynamic market.

The paper addresses the new product manager in the software industry. The focus of this paper is on the integration of pre-development and post-development management activities into the management of the new software product process. Traditional concepts of new product management are important to the product manager in the software industry. However, these concepts generally are intended for new products targeted for mature markets. Marketing management is often the new product manager's primary focus as described by these concepts.

The software industry, which caters to a relatively new and immature market, has just now started to realize the need for the integration of marketing management and new product management techniques into the software product management process. This need is driven by the rapid maturing of the software market, the phenomenal failure rate of new products, and the shortened life-cycle of software products due to the rapid introduction of new computer technology. Historically, software product management has focused solely on the complex software development cycle.

Software development has been such a severe problem for so long that it is still discussed as the whole of software management. This view worked well for many years while open markets existed with unsatisfied needs. However, the computer

and software markets have become increasingly competitive. Products which are unable to meet the needs and wants of the consumer are destined to fail. The intent of this paper is not to undermine the importance of the development process. Its intent is to stress the importance of integrating pre-development and post-development managerial activities into the new software product management cycle. This integration will significantly increase the odds that the costly software development phase will produce a successful product.

The managerial duties and activities of the new product manager are examined in this paper. The primary duties of the product manager include industry and corporate analysis, new product planning, software development, and product introduction. The identification of a life-cycle management approach to the new product process is the emphasis of this paper.

The maturing of software product management has been severely impeded due largely to the lack of or slow acceptance of management tools and techniques and a poor understanding of the unique aspects of software production and the software industry. Emphasis, over the past few years, has been placed on the development of technical tools and techniques as a means to improve the software product. However, there still exists a void in the overall management process of software product development. This void is the lack of emphasis on pre-development and post-development activities. (Fathi and Armstrong 1985) This void must be filled so that product managers can understand and effectively lead major software projects. The barriers, both educational and psychological, that confront the product manager are difficult to resolve. Cooper (1978) identifies several of these barriers. They include:

- 1) The lack of a well-balanced personnel team.

- 2) The tendency of project managers to be overly concerned with the development process and to not provide sufficient effort and emphasis on overall life cycle issues.

- 3) Inadequate and/or lack of proper education. These barriers indicate that the product manager is often technically-oriented and maintains primary interest in the actual development process. The same is true for the majority of his/her personnel. The result is a lack of focus outside the technical development process. The product manager in the software industry must strive to overcome these barriers, understand the dynamics and technologies involved in the computer software industry, and develop a life-cycle approach to software product management.

The objective of this paper is to integrate pre-development and post-development activities into the software product development process and to define a life-cycle new product management process which benefits the new product manager in the commercial software industry.

This paper is the result of careful analysis of the published literature written on new product management and software product/project management. Many methods and views of the new product management process are described in various texts and journals. Extensive literature searches have identified many of these sources. Many of the steps in these processes, as well as the processes themselves, are not applicable to the software industry. The chief criterion in the decision to include each step, or the process as a whole, was its applicability to the software industry. Those steps or processes bearing a direct relationship to software product management were included.

These literature searches also identified many sources on the management of the software process. These sources, however, tended to focus on the actual development process. The primary criterion in the decision to include the author's work was the applicability to the development of commercial, or marketable, software. The development of software for in-house use was not pertinent to this paper since this process is a small subset of commercial software development.

New product managers perform many management functions. Effective product managers must manage the product throughout its life-cycle. In order to effectively accomplish this life-cycle management approach, product managers must call upon a wide variety of skills and abilities ranging from technical expertise to marketing management. This paper addressed and analyzed the functions to be performed by the new product manager as applicable to the commercial computer software industry. The paper identified the process of new software product management and incorporated a product life-cycle approach.

The first issue addressed in this paper is pre-development activities. The new product manager must be able to analyze the software industry and its market, identify organizational strategies and objectives, and recognize the potential growth rate for new products in the organization. He/she must also assess the internal capabilities and culture of the organization in order to identify possible new product candidates. Overall, the product manager must be capable of appraising the product candidate's life cycle.

The new product planning cycle is perhaps the most critical step in the process. New product policy and strategy must be

defined. The new product must be classified and defined. The product mix and product line must be evaluated. In the software industry, product protection through copyrights and/or patents is a major issue for the new product manager. Issues such as idea generation and screening must be considered.

The software development process is explained in detail. This step is often the most timely and expensive part of the new product process. However, this process produces a product that is only as good as the pre-development activities specify. A study of this process identified the need for pre-development and post-development activities.

Post-development issues are also of major concern for the new product manager. Market testing and commercialization considerations were evaluated. This paper addressed promotion, distribution, and pricing strategies. Promotion strategies include issues of promotion mix, media mix, sales promotion, advertising, and personal selling. Distribution strategies involve decisions on marketing intermediaries and channels of distribution. Pricing strategies, which involve demand, supply, and product considerations, are also critical in the product management process.

This paper intends to address the many factors that an effective new product manager in the software industry must consider. The current trend of software product managers is to focus almost entirely on the development cycle. This paper addressed a broader, life-cycle, approach to new-product management for the software industry. The intent of this paper was not to make the software product manager an expert in the field of commercial software development. It was intended, however, to expose the reader to the commercial software development process which places appropriate emphasis on the pre-development and post-development management activities.

Chapter Two

Literature/Document Review

This paper is the result of the analysis of literature reviewed on the topics of new product management, software project management, software engineering, software marketing, marketing, promotion, marketing management, and the software industry. This chapter reviews the literature found on each of these topics and identifies the significance of each topic.

Over one hundred journal articles or book chapters were identified as pertinent to the completion of this paper. These articles and books were reviewed and referenced in this paper. Most sources were less than five years old and reflect the series of changes that have taken place in the fields of software, marketing, and management in the past decade.

Several articles were identified in the area of product management. The majority of these articles dealt with the subject of product management in generic terms. The primary sources of information on product management came from these magazines and journals: Journal of Advertising Research, Business Marketing, Journal of Systems Management, Industrial Marketing Management, Management Accounting, Inc, Journal of Small Business Management, Direct Marketing, Marketing Communications, and Harvard Business Review.

The search of the published literature also provided numerous articles covering the many changes in the software industry. These articles provided detailed historical information on the rapid growth, shakeout, and maturing of the software industry. The information contained in these articles provided insight into the complex and dynamic world of software management. The primary sources of this information include Business Week, Datamation, Business Marketing, Electronic Business, Dun's Business Month, Computer Dimensions, and Marketing Management.

Several key sources were identified in the search for information on the marketing of computer software. The sources identified provided descriptive information on the pricing strategies, distribution channels, and promotion of computer software. The sources which provided the majority of the pricing strategy information include Software Magazine, Computerworld, and Personal Computing. Most of the information of distribution was found in Computerworld, Business, Marketing Communications, Business Marketing, Journal of Marketing, and Electronic Business. Promotion information resulted largely from searches in Business Horizons, New England Business, Business Marketing,

Direct Marketing, The Quarterly Review of Marketing, Marketing and Media Decisions, Advertising Age, Public Relations Quarterly, and Industry Week.

The following books were found to best cover the areas of software project management/engineering: The Software Revolution, Software Engineering Environments, and Microprocessor Software Project Management.

The review of current literature on new product management identified the lack of research on new product management in the computer software industry. The reviewed literature dealt with the product in generic terms and did not identify the market or industry characteristics that make these processes inappropriate for some applications. These new product management techniques focused on the marketing management functions of the process. Little attention was given to development requirements that drive these functions.

The literature search identified a seven step new product process as described by Cooper (1988). This process was significant in that it identified the need for management focus in pre-development activities. Cooper defined these pre-development activities as the idea, preliminary assessment, and concept. These pre-development activities were identified as crucial to the success of the product.

Continued analysis of new product management combined with marketing management identified Peter and Donnelly's (1988) work on the new product management process. Although strongly marketing oriented, the pre-development activities identified were considered important to the overall product management process. The additional steps identified from this work included market segmentation strategies. Additional sources on marketing segmentation were analyzed and considered inadequate.

Additional information from Gorman (1987) completed the pre-development activities as defined for this paper. Additional sources were analyzed and considered redundant or inappropriate for incorporation into the pre-development activities for the purpose of this paper.

Software project management and software engineering techniques were the focus of analysis for the development chapter of this paper. The incorporation of work by Charette (1986) was fundamental to the purposes of the development process. This development process, relative to the others analyzed, described the development process in complete detail. This source covered all steps and information described in similar sources. For this reason, it is the primary literature source of Chapter Four. Fathi and Armstrong, through their 1985 publication, provided the primary source of information on software project management.

The definition of the post-development process was the result of literature searches on various subjects including marketing, promotion, distribution, and the software industry as described previously. Crawford (1983) provided the information for the majority of the post-development process including promotion and distribution strategies.

The extensive search of published literature verified the lack of research on industry-specific new product management processes. The analysis of available literature facilitated the synthesis of various methodologies and techniques to produce a new product management process specifically tailored to the computer software industry.

Chapter Three

Pre-Development Activities

The project manager has many responsibilities throughout the new product process. This process requires the manager to develop many skills and manage a variety of skilled personnel. He/She must be knowledgeable in the fields of marketing, software development, promotion and sales, and production. A model organizational structure for the new product manager and his/her subordinates is shown in Figure 3.1.

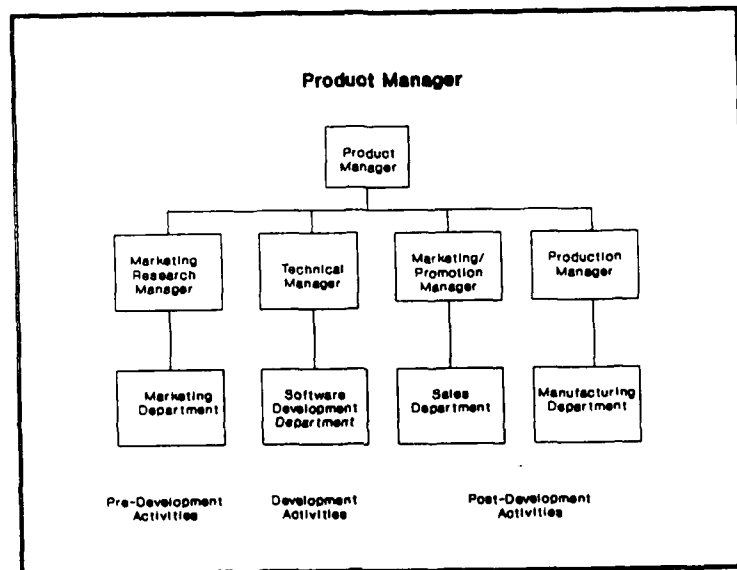


Figure 3.1

The process of creating, developing, and introducing a new product into the market requires dedication and persistence. There are many tasks to be performed, none of which are trivial. Each task requires unique skills and knowledge; therefore, the manager of the synthesis of these tasks has a unique challenge. He/She must be knowledgeable in each of the task areas but yet maintain a global perspective. Although the tasks to be performed are numerous, they divide easily into three categories. These are pre-development activities, software development, and post-development activities as shown in Figure 3.2.

Pre-development activities are the starting point of the new product process. These activities, as shown in Figure 3.3, define the product, its market, and its primary attributes. The product's success depends upon the effectiveness of these activities. Failure to effectively perform the pre-development activities will result in a product which does not meet the

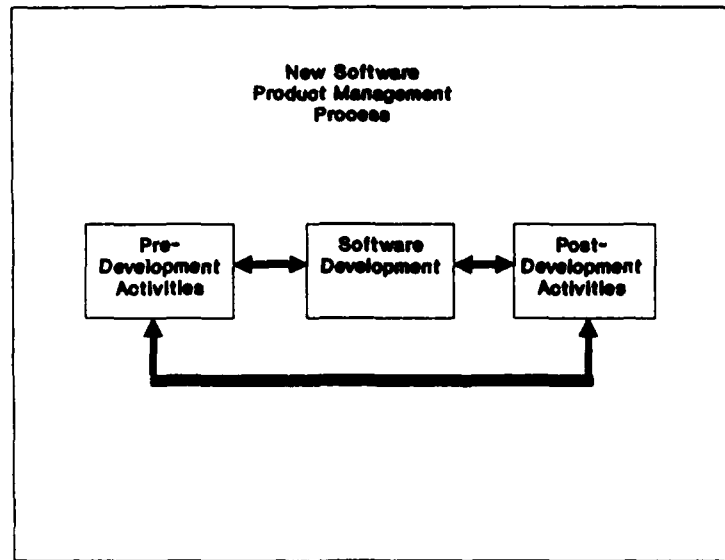


Figure 3.2

consumer's needs and wants. Carefully implemented pre-development activities will greatly increase the probability of producing a successful product. (Cooper 1988, 237)

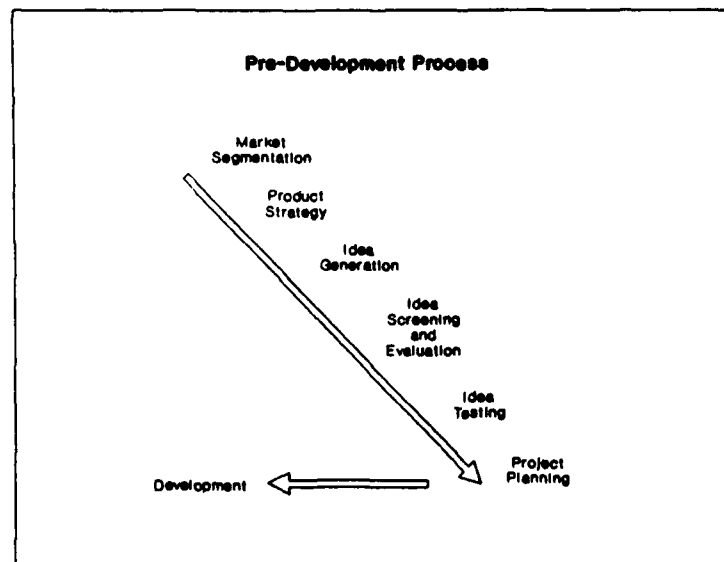


Figure 3.3

Market Segmentation

Market segmentation is critical to the new product management process. Market segmentation can be defined as the process of dividing a market into groups of similar consumers and selecting an appropriate target group for the new product. Peter and Donnelly (1988) divide the process of market segmentation into six steps. The six steps are shown in Figure 3.4 and will be discussed in detail.

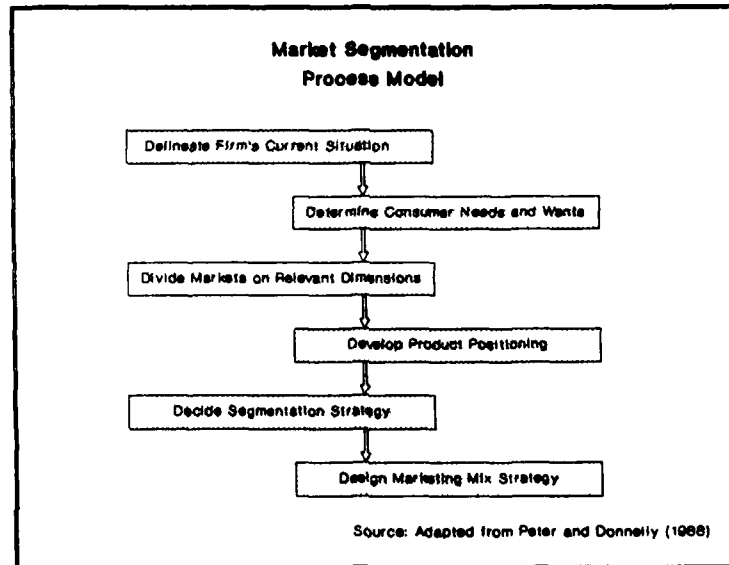


Figure 3.4

Market segmentation analysis is the beginning of a sound new product management process. The reason that segmentation analysis is necessary is that one product can seldom meet the consumer's needs and wants. However, a product can often meet the needs and wants of one or several consumer groups. The market segmentation analysis process helps the new product manager identify current trends in the market such as which products are serving which market segments and which market segments are worth targeting for the new product. Once the target market has been chosen, the feasibility of product development can be fully analyzed. (Peter and Donnelly 1988, 88-89)

• Delineate the Firm's Current Situation

The new product management process starts with an in-depth knowledge and understanding of the organization's mission and objectives. This knowledge will benefit the product manager during industry analysis and identification of the organization's role in the industry. Understanding these missions and

objectives can lead to product selection which will reinforce the firm's role in the industry as, for example, the industry's leader in technology. A full analysis of the firm's current situation begins after the project manager understands the firm's mission and objectives. In order to complete this situational analysis, six major environments must be studied. These environments are shown in Figure 3.5. (Peter and Donnelly 1988, 89)

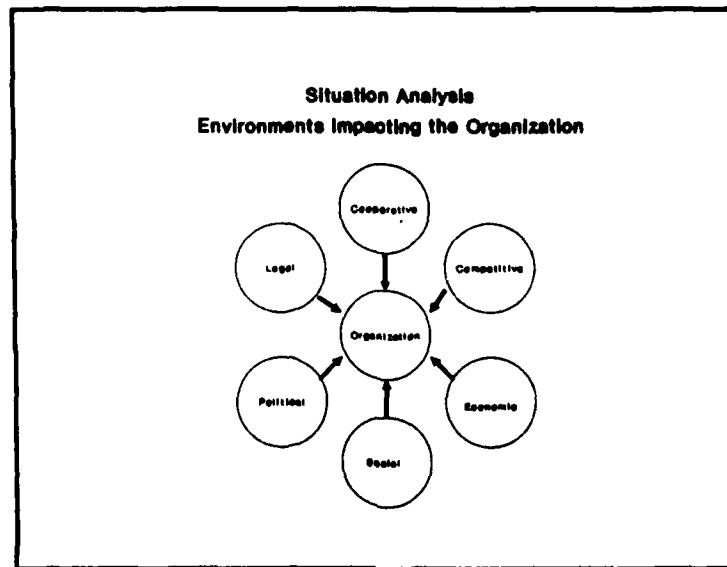


Figure 3.5

The first environment to be studied is the cooperative environment. This environment includes those individuals or organizations that share the desire to see the organization achieve its objectives. Included in this environment are suppliers, resellers, and other departments in the organization. The primary sources of opportunity resulting from the study of this environment appear in the form of increased productivity or efficiency. (Peter and Donnelly 1988, 89)

The second environment worthy of analysis is the competitive environment. Careful analysis of this environment can identify strengths and weaknesses in competitor's products. The identification of problems in the competitor's products will guide the product manager in the design and definition of the new product. Indications of significant market share by the competitor may suggest that the market segment studied may not be worth pursuing. (Peter and Donnelly 1988, 89)

The economic environment is also worth analyzing. Factors such as high inflation and/or high unemployment can affect the size and purchasing abilities of the target market. Careful

analysis can also identify the need for cheaper or top-of-the-line versions of existing or planned products. (Peter and Donnelly 1988, 89)

Analysis of the social environment can lead to the need or opportunity for new products. Factors to consider in this environment include social and cultural traditions, norms, and attitudes. (Peter and Donnelly 1988, 89)

Political Environment Analysis indicates public and organizational attitudes and reactions. The new product manager must strive to adapt the product, its marketing, and its quality to the public's attitude. (Peter and Donnelly 1988, 90)

The current legal environment must also be studied. Current legislative decisions and legal precedents impact the organization and the way it does business. (Peter and Donnelly 1988, 90)

Analysis of these individual environments will facilitate the identification of needs and opportunities for new products and increase his/her understanding of the total environment.

Determine Consumer Needs and Wants

It is important to identify the needs and wants of the consumer. The incorporation of these needs and wants into the new product process is crucial for the success of the product. The onset of new technology and/or other market dynamics often modifies the consumer's wants and needs and provides opportunities for new or modified products. Market research commonly provides this information which is used for segmentation purposes. (Peter and Donnelly 1988, 90)

Divide Market on Relevant Dimensions

This step of the segmentation process is considered to be the whole of market segmentation. There are primarily three decisions to be made in this step. The first is the decision to use a priori or post hoc segmentation. A priori segmentation is one where the segmentation decision is made prior to market research. Research is then conducted on the segment to determine its size and demographic as well as psychographic profiles. Post hoc segmentation occurs after research is conducted and is based on consumer attitudes and benefits sought in product categories. The size, demographic profiles, and psychographic profiles are then determined. A priori segmentation is more useful when the product manager has performed research on or has experience with the market. This is often used in the introduction of new versions of an existing product. The post hoc approach is useful in the segmentation for entirely new products. (Peter and Donnelly 1988, 90-91)

The second decision for the product manager is to determine the relevant dimensions to be used for segmentation. This area is somewhat subjective and relies on the manager's experience and expertise. However, the most market-oriented approach to segmentation is on the basis of the benefits the potential consumer is seeking. (Peter and Donnelly 1988, 91)

The product manager must also choose the useful bases for segmenting the market. Possible segmentation alternatives include benefit segmentation and psychographic segmentation. Benefit segmentation is division of the market on the basis of the benefits sought by the consumer in any given product. This approach attempts to measure consumer value systems and perceptions of a product class. Product managers can benefit from this approach by providing products with the benefits desired by the consumer. Psychographic segmentation attempts to identify the personal attributes of the consumer and follows a post hoc model segmentation. This approach produces information which can be used to develop product strategies. (Peter and Donnelly 1988, 91)

Develop Product Positioning

Product positioning is the attempt to place the product in the minds of the consumer relative to competing products. The positioning decision involves the selection of product features which are to be emphasized or de-emphasized. The positioning decision is crucial to the new product manager since positioning is often the central focus of the customer's perception of the product. Product positioning is usually accomplished by one or more of six approaches. The six approaches most often used are positioning by attribute, price/quality, application, product user, product-class, and competitor and are shown in Figure 3.6. (Aaker and Shansby 1982, 56)

Positioning by attribute is the most frequently used positioning strategy. This positioning approach associates the product with an attribute, a product feature, a consumer benefit of the product, or a consumer benefit relative to a competitor's product. Although price/quality is a product attribute, it is considered a separate approach because of its usefulness. Price can be used to reflect quality, value, or both. The use or application of a product is also used for positioning. This technique is used frequently but is seldom used as the primary focus of the positioning strategy. (Aaker and Shansby 1982, 56-58)

Positioning by product user is a positioning strategy used to associate a product with a user or class of user. Celebrity personalities are often used for this purpose. Product class is also useful as a positioning strategy. Either differentiation or

association is a worthwhile approach. Positioning with respect to a competitor is also used. A competitor's image can be exploited to communicate an image referenced to it. (Aaker and Shansby 1982, 58-62)

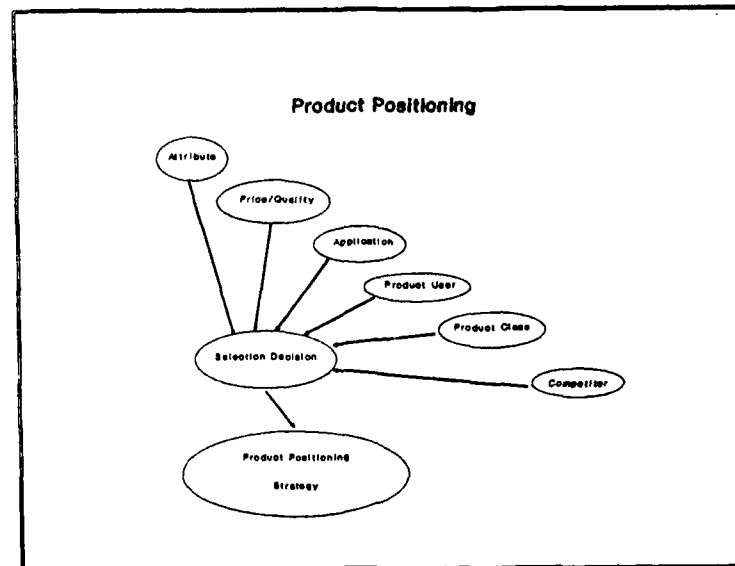


Figure 3.6

Decide Segmentation Strategy

During this step, the organization must develop the segmentation strategy. Four basic alternatives exist for the organization. The decision not to enter the market is the first alternative. The second alternative is to mass market the product and not segment the market. This alternative is viable if the market is so small that marketing to a segment is not profitable, heavy users are the majority of the sales volume, or a competitor's brand dominates the market and marketing to a few segments is not profitable. The third alternative is to market one segment. The last alternative is to market to more than one segment and develop a separate marketing mix for each. (Peter and Donnelly 1988, 100-101)

Once an alternative has been selected and a segment defined, the segment must be evaluated. In order for the segment to be viable, the segment must be measurable, meaningful, and marketable. The organization must be capable of measuring the size and characteristics of the segment. The segment must be large enough to generate the necessary sales and growth potential: this is measurable. A marketable segment is one that can be reached and served by the organization in an efficient manner. (Peter and Donnelly 1988, 101)

Design Marketing Mix Strategy

The marketing mix strategy incorporates the remainder of the marketing segmentation process. The marketing mix includes the development of a product strategy, a promotion strategy, a distribution strategy, and a pricing strategy. These strategies are developed in preliminary form during the pre-development process and finalized during the post-development process. (Peter and Donnelly 1988, 101-102)

Product Strategy

Commercial organizations survive and achieve growth through the sale of products and services; thus, effective product strategy is necessary for the survival and growth of the organization. An effective product strategy will increase the product's ability to survive both during its introduction and throughout its life-cycle. The product manager must consider and understand the nature of the product to be developed. This is generally achieved through product definition, product classification, and portfolio analysis as shown in Figure 3.7. (Peter and Donnelly 1988, 107-109)

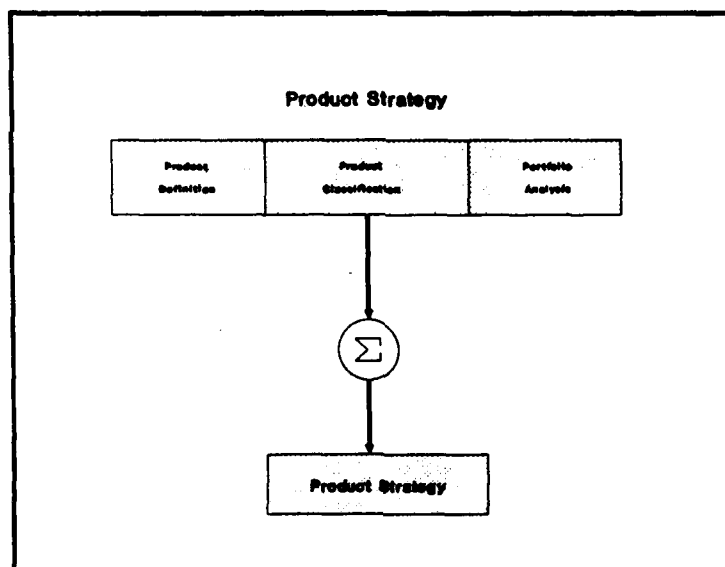


Figure 3.7

Product Definition

Product definition directly affects the survival, profitability, and growth of the organization. The product is defined as

the sum of the physical, psychological, and sociological satisfactions that the buyer derives from purchase, ownership, and consumption. (Peter and Donnelly 1988)

The chief purpose of product definition is to make the final decision of whether or not to develop the product. A decision to proceed at this stage marks the commitment of resources for the costly development effort. A secondary purpose of this stage is to develop the preliminary design requirements for the product. The identification of the benefits sought by the customer in that product class should result in product features, attributes, and preliminary design specifications. (Cooper 1988, 240)

Product Identification

Investigation of the products currently offered in the market is performed during the product identification process. The purpose of product identification is to seek insight into the current products and consumer buying behaviors in the market. Careful analysis results in an idea of what the "perfect product" is in the eyes of the consumer. Focus groups, surveys, personal interviews, user-groups, and observations are frequently used to gather the information. Several types of information usually result from this type of study. (Cooper 1988, 241)

Information such as the consumer's buying habits, perception of existing products, satisfaction with his/her present products, preference for other products, suggestions and complaints, and favorite features and attributes provides guidance for effective product identification. This information when correlated with an analysis of the competitor's products, their strengths and weaknesses, and their pricing and marketing strategies gives the product manager sufficient data to develop an effective product identification. (Cooper 1988, 241)

Product Classification

Product classification is useful to the product manager. Products with similar attributes can be placed into the same class. Products are generally classed by their market, either industrial or consumer. The motives and buying habits of each of these markets differ. Horizontal markets, where the product is purchased by all types of firms, and vertical markets, where the product is purchased by a narrow, but deep, buyer population, can

then be identified. Product classification is used by the product manager for the purpose of developing the marketing mix. (Peter and Donnelly 1988, 109-112)

The buyer's product perception can also be used as a basis for product classification. The buyer's product perception is the combination of the utilities and capabilities from the product expected to provide satisfaction. Satisfaction is perceived in terms of benefits minus costs. (Murphy and Enis 1986)

Product Portfolio Analysis

Product portfolio selection techniques are widely used by strategic planners and senior management. Product managers can also benefit by the use of these techniques. Portfolio analysis can improve new product decisions by evaluating the fit of the new product into existing product lines. (Lammey 1987, 64)

Portfolio analysis focuses on four key factors. Two of these factors are marketing variables, distribution channels and target markets, while the other two are financial characteristics, net cash flow and cash flow variability. The financial factors are obtained through standard financial analysis while the marketing variables are subjectively selected by the product manager. A synergistic evaluation can then be performed as described by Lammey (1987, 65).

The evaluation of product fit into the organization's product portfolio can identify product and market synergies. Products which evaluate favorably against market attractiveness and profit potential independently may detract from the organization's portfolio synergy. (Lammey 1987, 65)

Product Protection

The protection of the organization's product designs, ideas, and processes is a necessary consideration for the new product manager. In the computer software industry where pirated and cloned products can appear overnight, it is critical. In the software industry, this protection most often comes in the form of copyrights or patents. (Posch 1984, 190)

Patents offer protection for

Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new useful improvement thereof, ... (35 U.S.C. 101 1976)

A patentable product must also exhibit novelty and non-obviousness. The restrictions on what can be patented preclude its use for most software applications. The patent process, in addition, is quite lengthy, two to three years, and expensive, about \$7,500. (Posch 1984, 191-193)

Copyright protection is the most useful protection for the software product. The copyright is designed to encourage and protect the intellectual effort of the author and provide him/her the exclusive right to reproduce and sell it. The copyright protection is immediate and automatic and registration with the Copyright Office is not necessary. Infringement, however, is more difficult to prove in unregistered works. Registration at the copyright office requires that a copy of the source or object code be deposited for registration. This exposes the logic and structure of the software program to the public and the organization's competitors. This provides an opportunity for the competitor to analyze the code and develop a non-trivial variation of the product. (Posch 1984, 195-198)

Idea Generation

New product ideas are the start of any new product. Many methods exist for the generation of new product ideas. Few new product ideas develop from sheer inspiration; therefore, the product manager must take an active role in the development of new product ideas. The importance of this step of the process cannot be underestimated. Any deficiencies in this process result in problems in and/or failure of the product. (Cooper 1988, 241)

Ideas for new products can come from a variety of sources. The customer makes an excellent source for product ideas. The product manager is able to tap into this resource through periodic surveys of the customer's needs and wants, complaints, and suggestions. Contest schemes also work well in the generation of ideas from customers. This scheme offers prizes for the best ideas and encourages the customer to participate. (Cooper 1988, 241)

Sales and service groups also provide a source of new product ideas. These groups maintain close contact with the customer and are able to identify consumer problems. These problems often provide information which leads to new product ideas. Again contests and suggestion schemes offer an incentive for the sales and service personnel to offer their ideas. (Cooper 1988, 241-242)

Creativity or brainstorming sessions often provide a wealth of new product ideas. The product manager should attempt to mix the types of people, service, sales, engineering, etc., in the session to stimulate the flow of various ideas. (Cooper 1988, 242)

The competitor offers many new product ideas. Analysis of the competitor's products leads to the identification of strengths and weaknesses which may be exploited in a new product. Information concerning the competitor's product is often found in magazines and journals, and in the product itself. (Gorman 1987, 77)

Idea Screening and Evaluation

The idea generation phase produces a number of ideas that must be screened. The screening process helps to distinguish between potential winner and loser ideas for the organization. This process can be described as the tentative decision to commit resources to further product examination. It is not intended to allocate resources for full product development. (Cooper 1988, 443)

Customer need, producibility, profitability, and organizational fit are four critical criteria in the judgement of product concepts. These are shown in Figure 3.8. The customer need criterion is essential since most successful new products meet the customer's needs in some better and/or cheaper way. (Gorman 1987, 77)

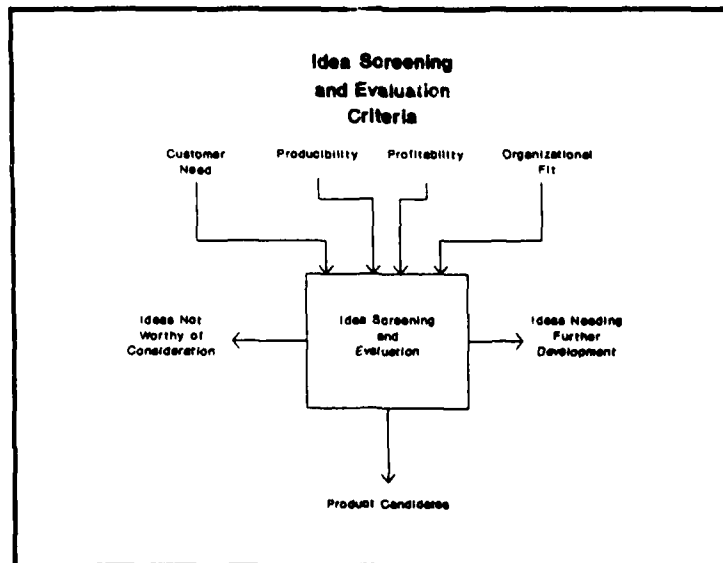


Figure 3.8

Producibility is another criterion worthy of examination by the product manager. The product must be evaluated to determine if it can be produced with existing organizational resources. The inability to produce the product with existing organizational resources requires the product manager to determine the need and availability of additional resources. (Gorman 1987, 78)

The profitability criterion identifies expected development costs as well as subsequent costs and expenses. From this information, revenue can be calculated and the profitability potential of the product can be determined. This criterion is a good indicator of expected return to the organization. (Gorman 1987, 78)

The organizational fit criterion helps the project manager determine how well the product fits into the existing product line, sales plan, and distribution channel. This step is an extension of the product portfolio analysis discussed previously in this paper. (Gorman 1987, 78-79)

The product manager's use of these four criteria allows the objective screening of new product ideas. This objective idea screening process also identifies weaknesses in all generated ideas. The identification of weaknesses in product ideas that pass and do not pass this stage leads to stronger product concepts. Accepted ideas can be improved. Unaccepted ideas can either be improved or modified to generate an acceptable idea. An organized idea screening process shows commitment to the new product development process. (Gorman 1987, 79)

Idea Testing

Prior to product development, it is often desirable to test the product to assure that it meets the needs and wants of the target market. At this point, it is still possible to make changes in the product definition and preliminary design with little cost or schedule impact. The sole purpose of this test is to study the acceptance of the product by the target market or segment. A prototype, model, or written description is generally sufficient for testing purposes. (Cooper 1988, 244)

There are six basic elements of idea testing as shown in Figure 3.9. These elements are an identified customer need, a product concept, an appropriate study design, a customer sample, proper execution, and a realistic evaluation of results. (Gorman 1987, 80)

Once the product has been defined, a sample or prototype should be developed. The sample or prototype should be as similar to the actual product as possible. Testing is most efficient when the test product represents the actual product as closely as possible. When a sample or prototype is not feasible,

a diagram or chart is often sufficient. Again, the idea is to represent the product as realistically as possible. (Gorman 1987, 80)

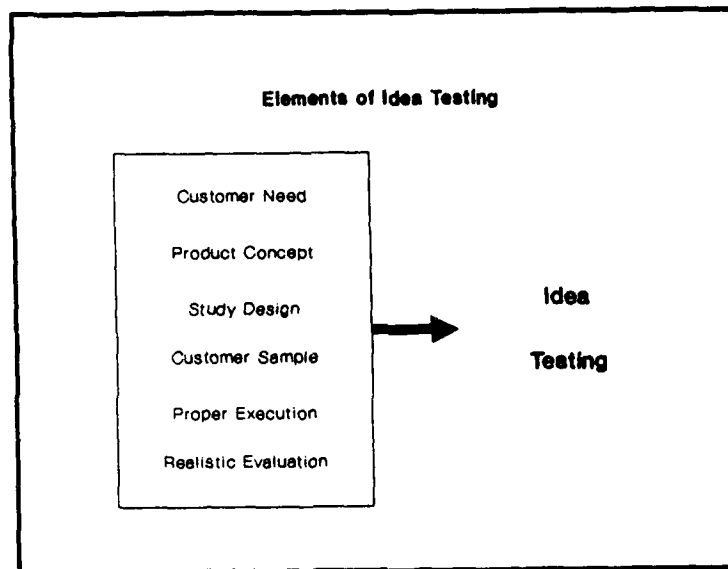


Figure 3.9

The consumer test group should be carefully selected and potential buyers of the product. Negative reactions from a carefully selected test group indicate the need to modify either the product or the target market. The testing of the consumer group can be achieved through techniques such as mail questionnaires, telephone or personal interviews, and consumer focus groups. In general, the complexity of the product drives the need for personal contact in the idea testing stage. Complex or innovative products generally require more personal contact with the consumer test group than do simpler products. (Gorman 1987, 80)

Idea testing helps the product manager to identify opportunities and minimize risk. Effective testing will identify the consumer's willingness to purchase, the desirable price for the product, and the changes necessary for the product to meet the expectations, wants, and needs of the consumer. (Gorman 1987, 80)

Project Planning

By the time the product manager reaches this point, the product, as well as its attributes, has been defined. The project planning phase is used to plan and control the development of the software product. Project planning helps the

product manager identify the tasks that need to be performed, the resources for each task, and the expected duration of each task. (Fathi and Armstrong 1985)

There are three initial steps in the development of a project plan for software products as identified by Reifer (1981). These steps are as follows:

1) A set of software development and management policies, including a long-range business plan, should be established. The policies should address issues such as configuration management, quality assurance, documentation, and other standards which have company-wide implication, and which will be used in developing software.

2) A business plan should be developed for each job in the organization, which describes the work to be done, general constraints and limitations, and the team required to carry out the job and the reasons why management should allocate resources (personnel, equipment, and facilities) to carry out the particular work.

3) A project plan should be developed for each authorized project defining the scope of the work to be done. The two main accomplishments of such a project plan are:

a. It provides upper management with a high level summary of the project.

b. It provides the project manager with a plan from start to end for monitoring project progress and allocating resources.

Again, the project plan should result in a breakdown of manageable tasks and an estimate of time and resources to complete each task. Various managerial tools and techniques are helpful in this planning and control process. The Gantt chart, the Program Evaluation Review Technique (PERT), and the Critical Path Method (CPM) are designed for this purpose.

Chapter Four

Software Development

The goal of the development effort is to build a system that performs its intended functions adequately at a reasonable cost. The following steps define the process of software development as pictured in Fig 4.1. The distribution of effort for the product's initial design is shown in figure 4.2. (Charette 1986)

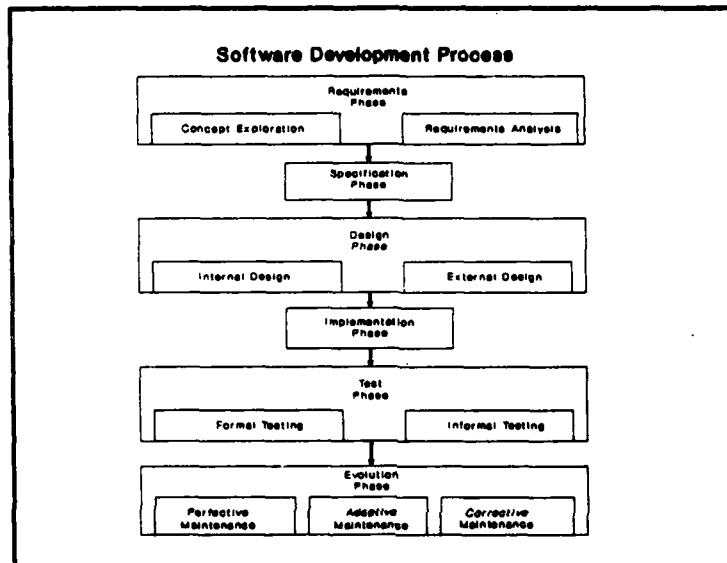


Figure 4.1

Requirements Analysis

The requirements phase of the software development process is actually a refinement of the pre-development activities. During this phase, the product description obtained through previous steps is converted into a functional description. This functional description is independent of the means involved to accomplish it. The important result of the requirements phase is an understanding of what the software is required to do to meet the consumer's needs. (Charette 1986, 85)

Another result of the requirements phase is consensus among all the people involved in the new product process. A consensus between management, developers, and users will help prevent conflicts and misunderstandings later in the product process, promote teamwork, and minimize product changes during development. (Charette 1986, 88)

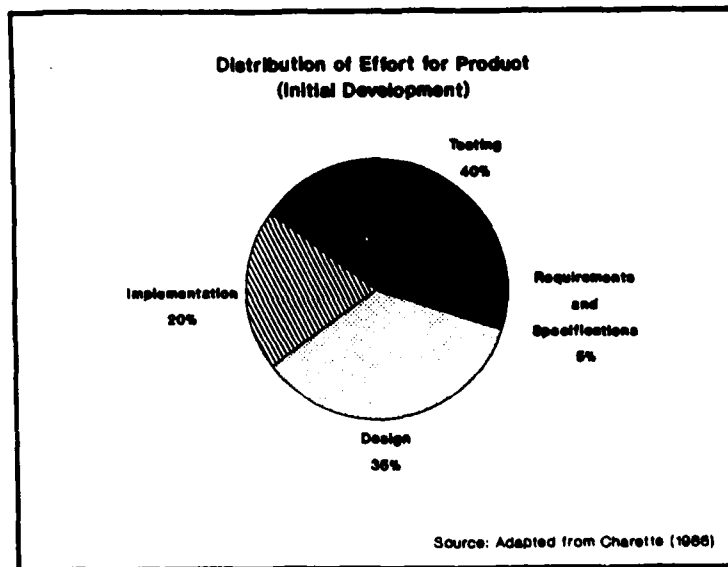


Figure 4.2

Concept exploration marks the first step in requirements analysis. The product's objectives are described and the technical, strategic, and economic considerations are discussed. The understanding of the objectives and their relative importance permits the technical personnel to establish tradeoffs in the design of the product if necessary. Once the objectives are understood, solutions are proposed. Often objectives are not technically or economically feasible and must be modified. (Charette 1986, 89-91)

During concept exploration, functional and non-functional requirements are determined. Functional requirements are necessary for the proper functioning of the software. They describe the inputs and outputs of the software product and define required tests for acceptance. Non-functional requirements are optional, but desired, and not easily testable or verifiable. Examples of non-functional requirements include maintainability or "user-friendliness". (Charette 1986, 91-92)

Requirements definition and analysis follows concept exploration. The main difference in concept exploration and this step is that this step produces formal, binding requirements. The results of concept exploration are finalized and reviewed. The software product is defined in detail. The standards, vocabulary, and conventions are formally created. Each requirement is described in detail with an explanation of how the requirement fulfills the product requirements and the consumer's needs. The end product is a description of what the software should be and how it should perform. (Charette 1986, 94-95)

Specification

The software specification phase identifies the tasks to be performed in the development phase. These tasks are then defined in terms of what must be done. The actual description of how these tasks will be done is performed in the design phase. The specifications phase focuses on the intended behavior of the software product as seen by an external viewpoint. (Charette 1986, 127-138)

This phase simplifies the design phase by developing a more precise, understandable description of the requirements document. Specifications must possess the following characteristics to be effective:

- 1) Correct and Complete - Incomplete and/or incorrect specifications make effective design and implementation impossible.
- 2) Consistent - Specifications which are contradictory will lead to confusion in design and development.
- 3) Unambiguous - Specifications must be described in detail in order to avoid confusion or misinterpretation.
- 4) Verifiable - The specification must meet product requirements. The end product must also be testable against the specifications.
- 5) Traceable - Each requirement must have a path defined to the specification.
- 6) Minimal - Only critical information should be included in the specification.
- 7) Modifiable - The specifications must be modifiable when changes occur.

Since specifications are the standard for measuring the correctness of the software product, they must possess all of these characteristics to be considered effective. (Charette 1986, 138-142)

Design

During the design phase, the software specifications are developed into a software architecture which represents the physical implementation of the software product. This software architecture is virtually a blueprint to be followed during the implementation phase. There are two activities performed during this phase. These are the external and internal design. (Charette 1986, 163-164)

External design is the definition of the externally observable characteristics of the software product. Internal design defines the details of the internal processing and structure of the software product. These two definitions compose the architectural design. Architectural design defines the program structure and the interfaces and connections among the software modules. Detailed design defines and selects the algorithms and data structures to be used in the implementation phase. (Charette 1986, 166-168)

Implementation

The implementation phase results in the production of the product structures, data structures, algorithms, and interfaces developed in the design phase. If the earlier steps in the pre-development phase have been conducted properly, this is a straight-forward process. However, this is rarely the case. (Charette 1986, 199-207)

The implementation phase is often chaotic and difficult for the product manager to track. This is due, largely, to the fact that even very effective requirements analysis, specifications, and design cannot predict all the problems or technical difficulties encountered in a major software development project. In reality, design errors lead to incorrect assumptions by the implementer which must later be corrected. Also, the intricacies of various computer operating systems and programming languages are often beyond the expertise of the product design team and, thus, are not considered in the design process. In addition, the implementation process is prone to human errors. The types of problems the product manager should be aware of are described in the following paragraphs. (Charette 1986, 202-204)

As mentioned earlier, problems often occur in the translation from design to implementation. The number of problems is related to the level of abstraction in the design. The translation process becomes more prone to errors as the level of design abstraction increases. Designers, although technically competent, often do not focus on considerations such as memory requirements for variables or the size and partitioning of the computer's memory. However, in implementation, these are necessary details to consider. Similar situations, where the implementer has to make key decisions, complicate the implementation process. (Charette 1986, 204-205)

Logic errors are another form of translation problem. The implementer will often interpret a logic design differently than the designer intended. This is the major source of error in the development process. The breakdown between requirements, specifications, design and implementation errors is shown in Figure 4.3. Although this problem is difficult to counter, open

communications between the implementer and the designer and/or involvement of the implementer in the design process will minimize this and other types of translation errors. (Charette 1986, 205)

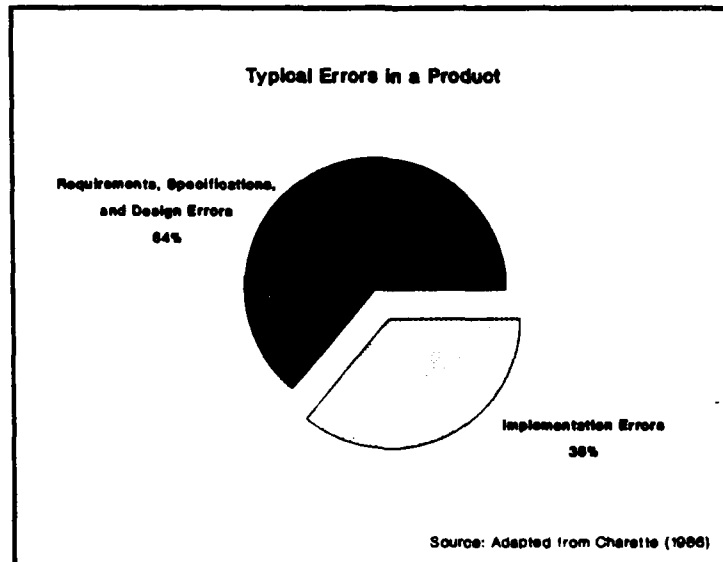


Figure 4.3

Domain problems are also common in the development phase. Often the implementer finds that the designer has not explicitly defined a situation that occurs during implementation. Certain run-time or execution errors not detected or expected are examples of domain problems. The designer could not foresee the problem, thus could not design for it, since this type of error is out of the designer's domain. (Charette 1986, 206)

Another domain problem is the use of system software. System software includes the operating system, run-time executives, and batch environments which manage computer resources such as memory, the microprocessor(s), and the input/output of the system. It is left up to the implementer to develop the product within design limitations and constraints. (Charette 1986, 206-207)

The implementer is faced with the task of making tough decisions on design and constraint tradeoffs. Most decisions are non-functional in nature making it difficult to predict the outcome of the decision. The tradeoffs in the implementation phase depend on how effectively the design can be translated for the implementation and how effectively it can be executed on the chosen computer system architecture. Several examples of some

tradeoffs that the implementer must make are reliability, cost, maintainability, efficiency, and timeliness as in Figure 4.4. (Charette 1986, 207)

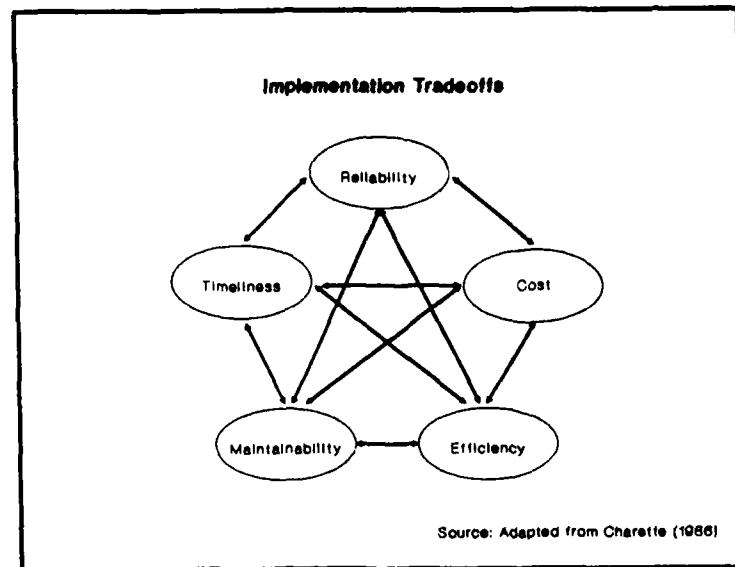


Figure 4.4

Test

The testing phase follows the implementation phase and attempts to locate and isolate physical and/or logical errors in the product. Both formal and informal testing are conducted. Informal testing is usually conducted during both the implementation and testing phase. This type of testing is usually performed by the implementer and is generally done on a modular basis. When the implementer completes a particular software module or subroutine, he/she then informally tests it to assure that it functions as intended. (Charette 1986, 208)

Formal testing begins as each module is completed. This testing attempts to identify exactly what the module or subroutine is doing. Once all modules or subroutines are tested, the modules are connected and tested as a unit, thus, as the finished product. Various tests are conducted and the results compared against expected results. (Charette 1986, 208-209)

It has proven currently impossible to completely test a program. The number of possible paths in a medium to large computer program is enormous and could take a computer several years to test. Therefore, a testing strategy must be developed. A model testing strategy is shown in Figure 4.5. (Charette 1986, 209)

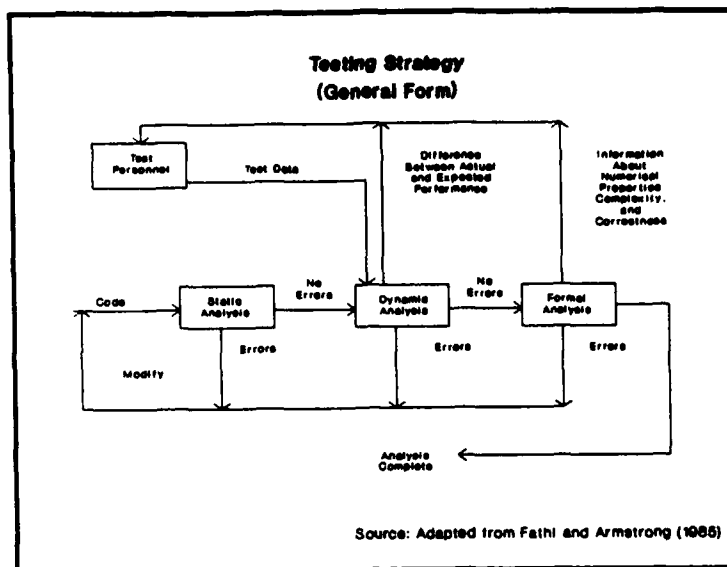


Figure 4.5

The key issues in testing are the identification of the components to test, the definition of how these components are to be tested, and the listing of what to expect from each test. (Charette 1986, 209)

The decision on what should be tested is critical. The size of the product is one consideration. Large programs need more testing done; therefore, they cost more to test. Another consideration is the complexity of the product. Complex systems with stringent timing requirements, for example, are more difficult, thus more expensive, to test. (Charette 1986, 209-210)

The decision of test method to use is based on the criticalness of the system. The two basic types of test methods most often used are static and dynamic testing. Static testing does not require the program to be executed on the computer. It requires code inspections by hand, structural walk-throughs, and logic tracing. A general form of static testing is shown in Figure 4.6. Dynamic testing requires execution of the program under controlled conditions. A general form of dynamic testing is shown in Figure 4.7. (Charette 1986, 210)

Both static and dynamic testing can be performed under the black box or white box perspective. Black box testing attempts to study the external behavior of the product. Product inputs and outputs are studied at the product level. White box testing studies the internal logic of the product and modules and focuses on the paths and branches in the program. (Charette 1986, 210)

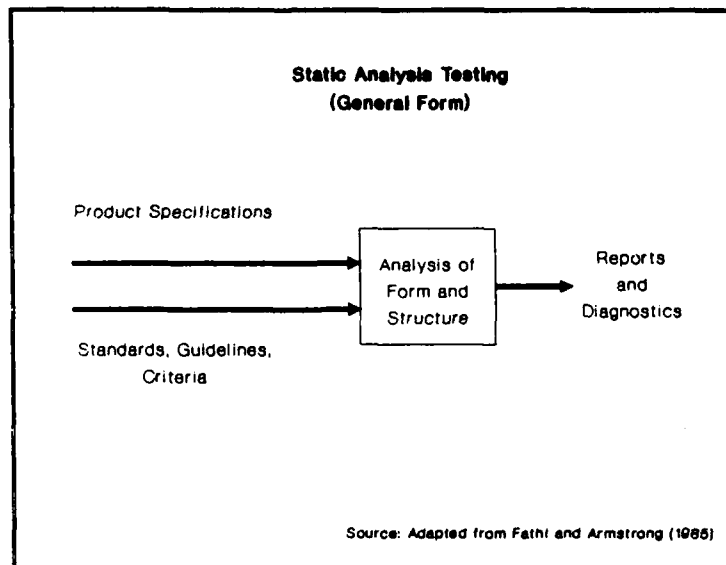


Figure 4.6

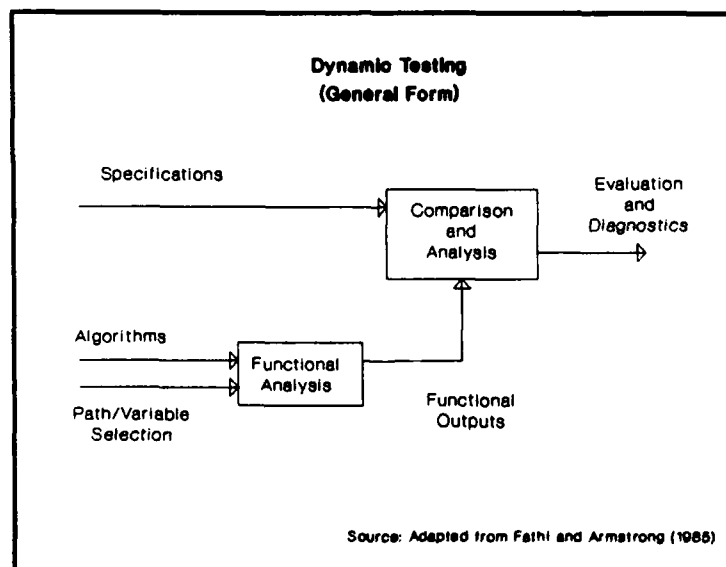


Figure 4.7

Evolution/Operations and Maintenance

The evolution phase is often called operations and maintenance. This phase follows the product throughout the rest of its functional life. Product changes such as functional enhancements or increased performance are necessary to increase the short-life of computer software products. There are three

basic types of evolution in software products. These are perfective maintenance, adaptive maintenance, and corrective maintenance. (Charette 1986, 211-214)

Perfective maintenance is product enhancement. Suggestions or requests by the customer, designer, or market researcher may identify the need for perfective maintenance. Adaptive maintenance is the planned modification of the product. These planned modifications usually are enhancements that were not considered feasible for the original product. Corrective maintenance refers to the modification of the product due to deficiencies or errors in the product after its release. (Charette 1986, 214)

The evolution phase is somewhat different than similar phases in traditional new product management philosophies. The product is modified but does not go through the entire new product process as would a modified product in the traditional philosophy. This unique software viewpoint enhances the desired life-cycle attitude of the new product process. The total distribution of effort in the life-cycle of development is shown in Figure 4.8.

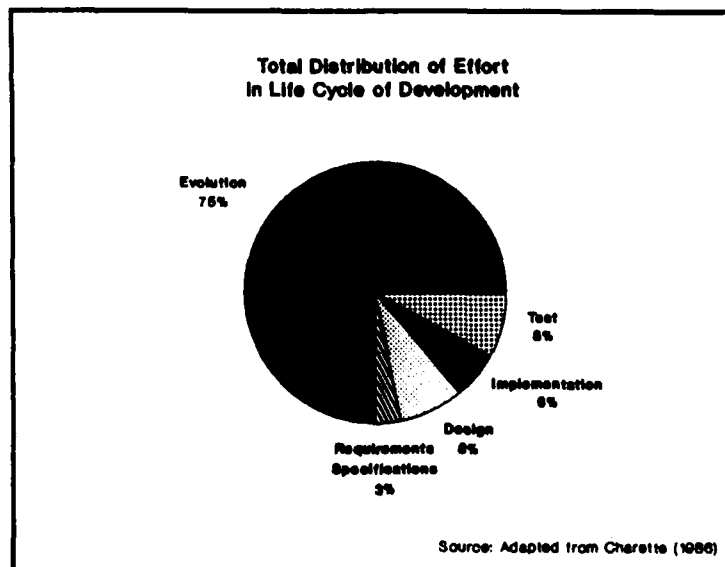


Figure 4.8

Chapter Five

Post-Development Activities

Post-development activities are performed to facilitate the release of the product into the market. These activities are not performed in isolation and may begin during the development process. The post-development strategies incorporate many of the pre-development ideas and results. The objective of these activities is to successfully launch the product into the target market. The primary activities to be performed during the post-development process are shown in Figure 5.1.

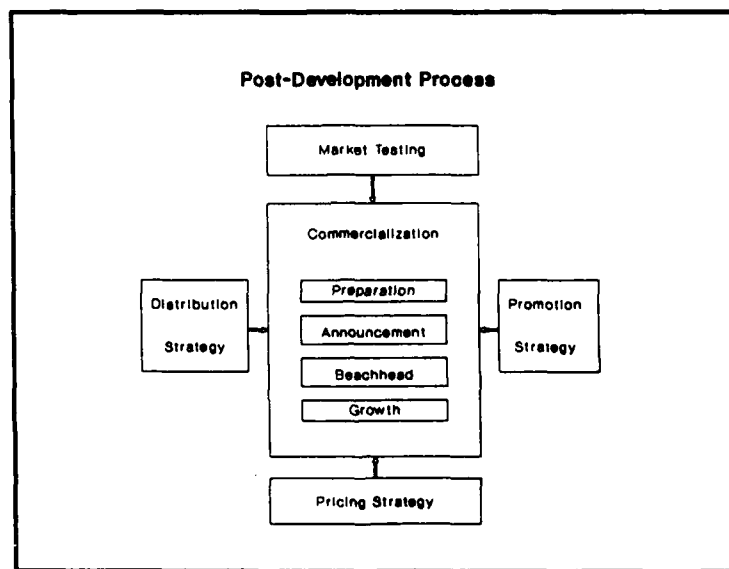


Figure 5.1

Market Testing

The purpose of market testing is two-fold. The product manager must first have an accurate forecast of sales volume. Earlier figures used for product decisions are not sufficient for this purpose. Accurate sales volume predictions are needed in order to perform necessary economic analysis on the actual product. Secondly, the product manager must have information to lead him/her in the modification of the existing marketing plan. (Crawford 1983, 410-411)

There are many methods of market testing; however, there are generally five types commonly used as shown in Figure 5.2. The five types of market testing are the attitude survey, the sales wave test, the laboratory test market, the controlled sale, and the full-scale test market. (Crawford 1983, 412-413)

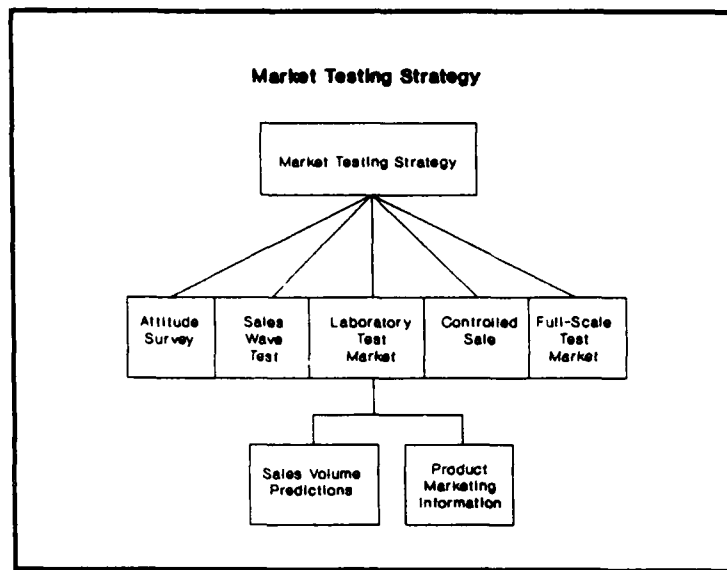


Figure 5.2

The attitude survey, once widely used, is slowly being replaced by more specialized tests. This market test method is still used in some situations, however. If the organization has a close relationship with key buyers, or if the new product is within the organization's field of expertise and experience, or if the new product is low risk, the organization may choose to use the attitude survey. (Crawford 1983, 413)

The attitude survey presents the product in its entirety. Price, packaging, services, etc. are presented to a select group of the target market. A sales presentation is made to the group which, in turn, responds to all questions. The method produces results which identify probable sales figures. This method produces good results but other methods which will be addressed offer better results. (Crawford 1983, 413-414)

The sales wave method of market testing identifies the consumer's desire for the product, his/her wear-out phenomenon, and his/her acceptance level. The process for the sales wave method begins with the contact of potential buyers. The product is then explained to the potential consumer and a trial or sample of the product is offered. After a specified time, the consumer is contacted again and encouraged to purchase the product. Subsequent calls provide the opportunity to gather additional data. This method produces better results than the attitude survey but lacks the control of the laboratory test method. (Crawford 1983, 415)

The laboratory test market is useful as a market test method since it offers the ability to control the test. This method simulates the full-scale test method which will be addressed in this paper. The cost of the laboratory test may be prohibitive for some organizations but is much less expensive than the full-scale method. The laboratory test method does not work well for entirely new products or ones that require personal selling, are unadvertised, are bought on impulse, or are seasonal. However, it is feasible for new products that expand or improve existing product lines. (Crawford 1983, 416)

The controlled sale offers realistic market feedback at a lower cost than full-scale test marketing. The new product is actually placed in the market for regular prices; however, the product is protected from many of the usual market forces. One method of protection is forced distribution where the product is given to the distributor or retailer. The catalog offers the simplest method of controlled sale. Special catalogs can offer the organization the opportunity to contact buyers and obtain feedback on the product. These and other methods of the controlled sale gather information on initial and repeat purchases, consumer attitudes, and product usage. (Crawford 1983, 417-418)

Test marketing provides the best feedback on potential sales volume in a new product. The product is released without any protection in a representative portion of the target market. The purpose of test marketing is not necessarily to decide whether or not to distribute and market nationally but is to determine the best way to distribute and market nationally. Test marketing is the most expensive method of market testing but provides the best sales forecast and evaluation of the overall product strategies. It reduces the chances of a product failure at the national level. (Crawford 1983, 419-420)

Commercialization

The commercialization phase begins after the organization has decided to market the product. This process is divided into a series of phases which relate to the phases of the product life-cycle. These phases are preparation, announcement, beachhead, and growth. Figure 5.3 shows the relationship between sales and expenditures and these phases. (Crawford 1983, 489-490)

The preparation phase includes activities that precede the new product announcement and permits optimal timing of this announcement. Four types of activities are included in this process. They are building marketing capability, service capability, presale promotion, and stocking availability as shown in Figure 5.4. (Crawford 1983, 491)

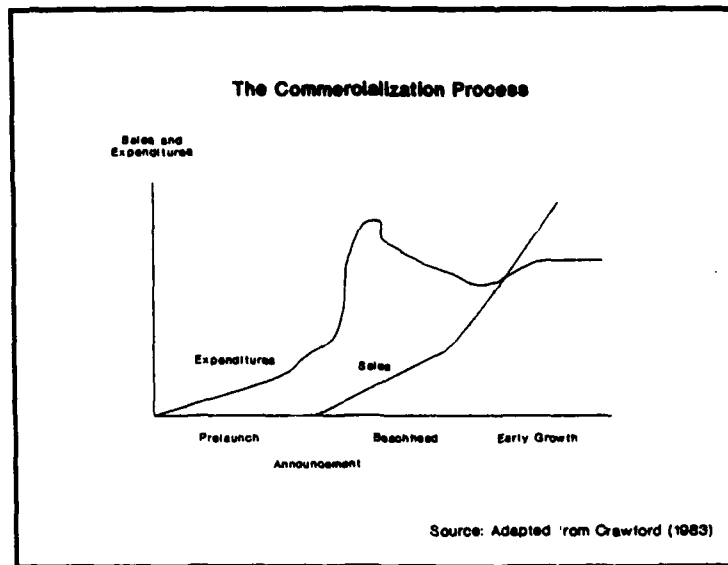


Figure 5.3

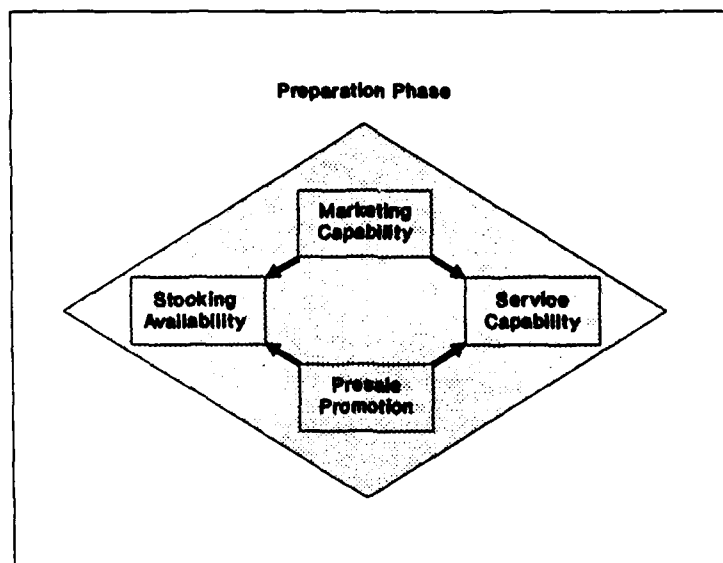


Figure 5.4

The building of marketing capability refers to the first type of preparation. New marketing capabilities are often needed to launch the new product. The product manager must be able to assess the current capabilities and determine the need for additional sales people, departments, etc. (Crawford 1983, 492-493)

The assessment of service capability is also a type of preparation in the commercialization process. The need for pre-sale and post-sale service will drive the size requirements for the service department. More service personnel are needed for complex software packages that are difficult to install and learn. (Crawford 1983, 494)

The new product manager must also determine the appropriateness of pre-sale promotion. Truly innovative software products are often not promoted prior to availability for proprietary or trade secret reasons. Another reason pre-sale promotions are often avoided is that software producers have historically had trouble releasing products when promised, thus losing credibility with their customers. (Crawford 1983, 494-496)

The last type of preparation is stocking and availability. The product must be available when and where the customer wants it. The demand for a new product will not likely survive non-availability or be stimulated by the fact that it is difficult to obtain. (Crawford 1983, 496)

These four activities comprise the preparation phase of the commercialization process. These activities are not performed on their own. They are completed with overall considerations on the post-development process. (Crawford 1983, 497)

The second phase of the commercialization process is product announcement. This phase, although very short, is important. Failure to receive recognition by the target market may mark the failure of the product. This phase is discussed in more detail in the promotion strategy section. (Crawford 1983, 497-498)

The third phase of the commercialization process is the beachhead. The objective of the beachhead phase is to stimulate the sequence of events that will cause the customer to purchase the product. This phase includes advertising, promotion, and sales. This phase incorporates the promotion strategy which is addressed later in the paper. (Crawford 1983, 499)

The growth phase follows the product throughout its life-cycle. The growth phase implements the post-development strategies yet to be discussed. The objective of the growth phase is to extend the product's life-cycle indefinitely. The post-development strategies are modified as necessary. Any changes in the product are accomplished in cooperation with the evolution phase of the development process. (Crawford 1983, 500-501)

Promotion Strategy

The activities performed during the development of the promotion strategy are shown in Figure 5.5. These activities, although each is unique, are not performed independently. The desired goal of the product strategy is to use the combination of these activities to develop a synergistic product promotional effort.

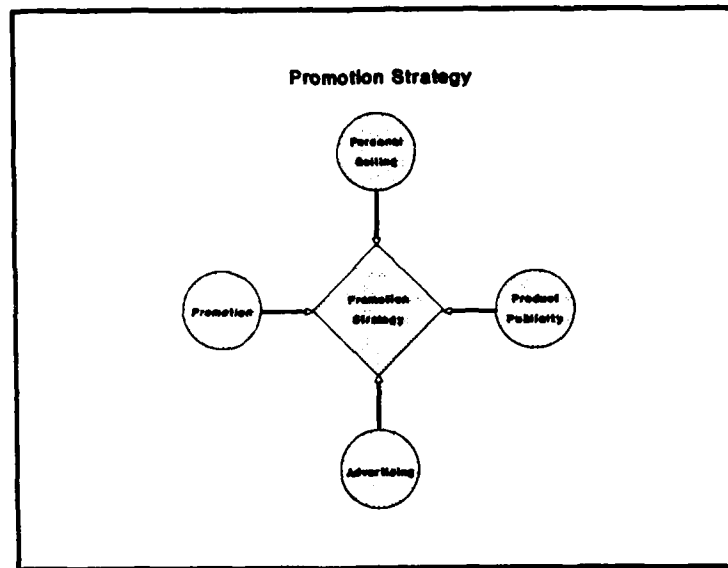


Figure 5.5

Promotion

Most organizations use one or more forms of promotion in the release of new products. The combination and types of promotional effort expended on a product refer to the product's promotion mix. Three basic factors should be taken into account when developing this promotion mix. Peter and Donnelly (1988, 136-139) define these factors as the role of promotion in the overall marketing mix, the nature of the product, and the nature of the market.

Sales promotion, as defined by the American Marketing Association, includes:

those marketing activities, other than personal selling, advertising, and publicity, that stimulate consumer purchasing and dealer effectiveness, such as displays, shows, and exhibitions, demonstrations, and various nonrecurrent selling efforts not in the ordinary routine. (Alexander 1960)

An example of sales promotion for software products is the trade show.

The most commonly used sales promotion technique for computer software is the trade show. The trade show offers the organization the opportunity to identify prospective customers, serve current customers, introduce new and/or improved products, promote the organization's image, test new products, gather information on competitors, and sell. Trade shows are an important part of the promotion strategy and influence the consumer's acceptance and recognition of the new product. (Kerin and Cron 1987)

Advertising

Advertising is the most flexible and controllable marketing tool. However, the strategy for the advertising of new products is difficult to develop. The first consideration in the development of the advertising strategy is to determine the applicability of advertising for the product. (Crawford 1983, 550-553)

Crawford (1983) states that if several of the the following factors exist, advertisement is applicable.

- 1) Differentiable product. The product must be meaningfully different from the competitor's.
- 2) Hidden Qualities. If the product has qualities that are not visible prior to, during, or after the purchase, the advertisement of these qualities is worthwhile.
- 3) Sold with strong emotional appeals or buying motives. If sale of the product depends on emotional rather than rational appeal, advertising is appropriate.
- 4) Favorable conditions for an economic expenditure. Advertising is appropriate if the organization is facing a cash shortage, a narrow window of market opportunity, or fierce competition.

The second issue to address in the development of this strategy is to define the objectives of the advertising. The objectives are often difficult to identify and change with shifts in the target market. Some objectives include creating awareness and understanding of the product, generating favorable attitudes toward the product, motivating buying action, or reinforcing the buying decision. (Crawford 1983, 553)

Personal Selling

Personal selling is applicable to the computer software market. Many software firms today are targeting vertical markets. The offering of industry-specific software to vertical markets is the fastest growing part of the software market. These packages are more expensive than the typical software package aimed at horizontal markets and require close contact with the customer. Personal selling is the best type of promotion strategy for this type of market. The salesperson can introduce, demonstrate, and help service the product. (Field 1985)

Product Publicity

Product publicity is extremely useful as a marketing and promotional tool. The objectives of product publicity are similar to the objectives of advertising. However, advertising is the paid promotion of the product while product publicity is free promotion. Product publicity is important to the effective promotion of new products for several reasons. Product publicity has high credibility, costs little, and informs the customer. (Williams 1988)

The computer software industry supports the objectives of product publicity. Numerous magazines and journals are available for publicity purposes. Product reviews and announcements are often the focus of such magazines and journals. Consumers depend on these reviews for purchase decisions; therefore, it is important to publicize the availability of the product.

Distribution Strategy

The distribution strategy is developed to optimize the movement of goods from the manufacturer to the consumer. This strategy is crucial since it is the end goal of the new product management process. This strategy is difficult to develop and even harder to change. (Baker 1987, 235)

Market intermediaries are often used by the manufacturer to perform a variety of post-development activities. Product promotion, pricing, and transportation are all commonly done by the intermediary. Since these activities are the intermediary's specialty, the intermediary can often achieve more success than the manufacturer in the distribution area. (Baker 1987, 235)

The manufacturer must make choices even when using intermediaries. These choices include the number of intermediaries to use, the type of intermediary to use, and the tasks that each intermediary will perform. The selection of the

intermediary will depend upon four criteria. The first is that the intermediary must be oriented to serving the organization's target market. The intermediary must also help the organization exploit any competitive advantage in the product. Third, the intermediary must be cost effective. Lastly, the intermediary must have the desire and motivation to distribute the product. (Baker 1987, 235-236)

Once established, distribution channels are not easy to change. However, the changes in the market or organizational environment may dictate that the distribution channel be modified. The product strategy should be developed such that contingencies are planned for and problems during the modification and transition of the distribution channels are minimal. The organization must continually monitor the performance of its existing distribution channels and be prepared to modify them if necessary. (Baker 1987, 236)

Pricing Strategies

An effective pricing strategy is critical to the success of the product. Price affects many of the decisions in the new product process. Product design, after-sales service, promotional efforts, and others are all affected by the pricing decision. (Chisnall 1989, 158-159)

The overall goal of pricing is to cover cost and produce a profit. However, it can be used, for example, to enhance market share or achieve levels of return on investment. Most organizations set their pricing strategies relative to the market environment. Factors such as scarcity or technological innovativeness can drive the price of a product up. (Chisnall 1989, 161-162)

Supply and Demand Influences on Pricing

The supply-demand position of the product is a major factor in the development of the pricing strategy. The demand for the product can be affected by its price. As discussed earlier, price can reflect value and/or quality. Products can be positioned with respect to price in order to meet the market's expectations. Demand usually drives the setting of price ceilings and floors in the target market. It is important to realize, however, that the initial pricing strategy must be flexible. The strategy may be changed by promotional activities, reductions in manufacturing costs, competitive activities, or technological developments. (Chisnall 1989, 162-163)

Risk-Aversive Pricing

Most current pricing strategies are developed to reduce the risk of low margins, avoid bottlenecks, and improve cash flow and are cost based or selling related. (Guiltinan 1976, 10-11)

Cost based pricing strategies are developed to cope with cost uncertainties and the pressures of profit margin. Two basic types of cost based pricing strategies are described in the following paragraphs. (Guiltinan 1976, 11)

Adoption of "delayed-quotation" pricing refers to the practice of delaying the pricing decision until the product has become a finished good. This practice is a result of long development times and variations in the prices of competing products. (Guiltinan 1976, 11)

The adoption of the "escalator" clauses pricing strategy refers to the practice of increasing the price based on predetermined criteria. The goal of this strategy is to alleviate the risks involved as cost increases. The effectiveness of this strategy depends on the organization's ability to change the criteria with changes in the market and the customer's willingness to accept the price change. (Guiltinan 1976, 11-12)

Selling-related pricing strategies strive to increase margins by reducing customer incentives. These strategies, in effect, attempt to direct sales efforts to nonprice approaches. Three basic types are described below. (Guiltinan 1976, 11-12)

The unbundling of services approach lists packaged goods separately. For example, computer languages often come with debuggers, quick compilers, optimizing compilers, and text editors. This strategy would separate the language package and list each item as an individual product with its own price. The sum price of these individual items usually exceeds the price of the package and, thus, represents the elimination of a form of discount to buyers purchasing the package. (Guiltinan 1976, 12)

Another strategy is to reduce cash and quantity discounts. These discounts represent a direct reduction in profit margins. However, this type of strategy will often affect the distributor/wholesaler's willingness to handle the product. (Guiltinan 1976, 13)

The elimination of "price-shading" is another risk-averse strategy. Price-shading refers to the varying, or shading, of reductions from list price. This shading is determined by

negotiations between the buyer and the seller. Elimination of this practice leads to single price sales and attempts to place emphasis on nonprice issues during sales. (Guiltinan 1976, 13-14)

Price is a competitive tool for increasing demand. However, it is important to realize that proper pricing strategies can place appropriate emphasis on the nonprice attributes of the product. Risk-averse pricing strategies attempt to do this. (Guiltinan 1976, 14-15)

Chapter Six

Summary and Conclusions

Review

This paper described the new product management process for the commercial computer software industry. The new product management process was divided into three major activities. These activities are pre-development activities, software development, and post-development activities. The tasks performed during each of these activities were discussed.

Summary

The new product management process in the computer software industry varies from the traditional new product management process. The software industry, due to its dynamic environment, has historically focused on the development process with insufficient attention paid to pre-development and post-development activities.

Traditional views of new product management focus on the marketing management functions of the process with little to no attention paid to the development process. These views or philosophies are not entirely appropriate for new product management in the software industry. The dynamic and complex environments of the computer software industry require that the product manager be knowledgeable in the field of computers and computer software. A lack of knowledge in these areas will result in inappropriate assumptions and actions in the pre-development and post-development phases. The same is true for a lack of knowledge in the marketing, sales, and production fields. The product manager must understand how these fields can help to define and promote the software product.

Conclusions

This paper identified the process of new product management for the computer software industry. This process is the synthesis of product management and software engineering techniques. This process identifies the critical need of technically-oriented product managers with an understanding of pre-development and post-development techniques. This process does not intend to suggest that product managers in the software industry must be marketing, sales, and promotion experts. It does, however, suggest the importance of an understanding of how these activities fit into the software development process. The incorporation of the pre-development and post-development activities into traditional software project management and software engineering techniques will result in improved product performance.

The manager of the new software product process must understand the activities which occur during the life-cycle of the product. Each activity in the life-cycle of the product process requires unique knowledge and skills. The pre-development activities require the product manager to understand the processes of marketing research, marketing segmentation strategies, idea generation, and product definition. More importantly, the manager must understand how these activities combine to produce effective product definitions and requirements. The manager must also be able to transition the pre-development results into the development process.

The development process requires that the product manager understands the basics of computer architectures and software. He/She must be able to develop the requirements and definitions defined during the pre-development activities. The manager must direct this process such that the developed product meets these requirements and definitions. If the requirements are unobtainable, the manager must be technically competent enough to evaluate alternative designs and tradeoffs and manage the changes in the development process. The development process is a highly technical task. In order to effectively manage the process the product manager must have a sufficient level of technical understanding.

The post-development process encompasses many of the skills from both the pre-development and development processes. Again the manager must be able to integrate technical and marketing skills and effectively manage both technical and management personnel.

The new product management process described in this paper is not suggesting that the new product manager must be able to perform all the tasks in the process. It is the manager's job, however, to understand the reasoning behind these tasks and to effectively integrate these diverse activities in a manner which provides the optimal product for the market.

Recommendations

Product managers in the software industry must take a life-cycle view of product management. The practice of current software project management and software engineering techniques pays too little attention to the needs and wants of the customer. The incorporation of pre-development and post-development techniques into the new product management process will improve product performance by more directly addressing the needs and wants of the consumer.

Further research needs to be conducted on the subject of new product management in the software industry. Research on the interfaces between the development activities would benefit the software industry. A case study of one of the major commercial software vendors would provide valuable insight into the software product process. As it currently stands, there is very little real data available on this process. A standardized process which has been tested and proven effective would significantly contribute to the software industry.

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